## Approach for Total Nitrogen Limits in the Great Bay Estuary

Description of Impairments and Effects:

To assess the condition of the Great Bay Estuary EPA considered:

- NOAA Estuarine Eutrophic reports from 1997, 1999, and 2007. Chronicle the increasing impacts of nitrogen within Great Bay as well as other estuaries around the nation.
    - 1997 - "In Great Bay, chlorophyll a concentrations range from low to high and turbidity from low to medium. Nuisance and toxic algal blooms have an impact on biological resources in subareas of the mixing and seawater zones. Nitrogen and phosphorus concentrations are medium. There are no observations of anoxia, however hypoxia is reported in small subarea of the mixing zone. SAV coverage ranges from very low to high."
    - 1999 – "By the year 2020, eutrophication symptoms are expected to worsen in about one-third of the systems, primarily due to increased nutrient inputs from population increases and the growth of the aquaculture industry. Of these estuaries, St. Croix River/Cobscook Bay, Great Bay, and Plum Island Sound are expected to worsen the most."
    - 2007 - "In Great Bay, increases in dissolved inorganic nitrogen have occurred over the past 20 years. Increases in chlorophyll a and turbidity have been identified with augmented eutrophication in the inner estuary. As a result, eelgrass biomass has declined by 70% in the last 10 years and the occurrence of nuisance macroalgae is becoming more evident. Primary symptoms are high but problems with more serious secondary symptoms are still not being expressed. Nutrient related symptoms observed in the estuary are likely to substantially worsen."

- State of the Estuary Reports. Chronicle the condition of the Great Bay Estuary over time.
    - 2000 - The State of New Hampshire's Estuaries (New Hampshire Estuary Project, 2000) indicates that declining water quality, in part due to nutrient overloading, has been a concerning trend for a decade or more.
    - 2003 - "Despite the increasing concentrations of nitrate+nitrite in the estuary, there have not been any significant trends for the typical indicators of eutrophication: dissolved oxygen and chlorophyll-a concentrations. Therefore, the load of nitrate+nitrite to the bay appears to have not yet reached the level at which the undesirable effects of eutrophication occur."
    - 2006 - "More indicators suggest that the ecological integrity of the estuaries is under stress or may soon be heading toward a decline." "Dissolved oxygen concentrations consistently fail to meet state water quality standards in the tidal tributaries to the Great Bay Estuary." "Nitrogen concentrations in Great Bay have increased by 59 percent in the past 25 years. Negative effects of excessive nitrogen, such as algae blooms and low dissolved oxygen levels, are not evident. However, the estuary cannot continue to receive increasing nitrogen levels indefinitely without experiencing a lowering of water quality and ecosystem changes."
    - 2009 - "Eleven of 12 environmental indicators show negative or cautionary trends – up from seven indicators classified this way in 2006. Total nitrogen is

increasing and eelgrass is decreasing within the estuary. The total nitrogen load to the Great Bay Estuary has increased by 42% in the last five years. In Great Bay, the concentrations of dissolved inorganic nitrogen, a major component of total nitrogen, have increased by 44 percent in the past 28 years. Eelgrass cover in Great Bay has declined by 37% between 1990 and 2008 and has disappeared from the tidal rivers, Little Bay, and the Upper Piscataqua River. Dissolved oxygen is currently exhibiting a cautionary trend. While dissolved oxygen standards are rarely violated in the bays and harbors they are often violated in the tidal rivers. The negative effects of the increasing nutrient loads on the estuary system are evident in the decline of water clarity, eelgrass habitat loss, and failure to meet water quality standards for dissolved oxygen concentrations in tidal rivers. The most pressing threats to the estuaries relate to population growth and the associated increases in nutrient loads and non-point source pollution."

  - 2013 - Of the 22 indicators, 15 are classified as having cautionary or negative conditions or trends, while 7 show positive conditions or trends. The overall assessment concludes that there is reason to be concerned about the health of our estuary, and that increased efforts to study and restore our estuaries are needed. "At this time the Great Bay Estuary exhibits many of the classic symptoms of too much nitrogen: low dissolved oxygen in tidal rivers, increased macroalgae growth, and declining eelgrass (SOE, pg. 12). Additionally, the report indicates that "…there have been persistent and numerous violations of the dissolved oxygen standards at stations in the tidal rivers that flow into the estuaries" (SOE, pg. 18).

- Status of the receiving water.
  - Estuarine portion of the Cocheco River on the 303(d) list aquatic life and primary contact recreational uses due to total nitrogen and chl-a levels.
  - Monitoring data for the estuarine portion of the Cocheco River from NHDES's 2009 Nutrient Criteria for the Great Bay Estuary (data from 2000-2008) and water quality data collected in 2012 and 2013 by EPA. Dissolved oxygen concentration violations observed in the river. Median TN concentration for 2000-2008 is 0.76 mg/l. Average TKN in 2012 is 0.98 mg/l. Average TN concentration in 2013 is 0.69 mg/l.
  - Monitoring data for the Upper Piscataqua River from NHDES's 2009 Nutrient Criteria for the Great Bay Estuary (data from 2000-2008) and water quality data collected in 2012 and 2013 by EPA. Documented dissolved oxygen violations. Median TN concentration for 2000-2008 is 0.52 mg/l. Average TKN in 2012 of 0.67 mg/l. Average TN concentration in 2013 is 0.41 mg/l.
  - Upper Piscataqua River has lost historic eelgrass coverage.
  - Lower Piscataqua River had a median TN concentration of 0.3 mg/l.

<u>Total Nitrogen Thresholds for Dissolved Oxygen and Eelgrass:</u>

Regulatory Basis for Establishing Total Nitrogen Thresholds:

- The State of New Hampshire does not have a numeric standard for total nitrogen.

- There is a narrative standard which states that Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses and that existing discharges containing either phosphorus or nitrogen which encourage cultural eutrophication shall be treated to remove phosphorus or nitrogen to ensure attainment of water quality standards.
- Pursuant to 40 CFR 122.44(d), "Where a State has not established a water quality criterion for a specific chemical pollutant that is present in an effluent at a concentration that causes, has the reasonable potential to cause, or contributes to an excursion above a narrative criterion within an applicable State water quality standard, the permitting authority must establish effluent limits using one or more of the following options…"
- EPA is utilizing 40 CFR 122.44(d)(vi)(A) which states that effluent limits are established, "using a calculated numeric water quality criterion for the pollutant which the permitting authority demonstrates will attain and maintain applicable narrative water quality criteria and will fully protect the designated use. Such a criterion may be derived using a proposed State criterion, or an explicit State policy or regulation interpreting its narrative water quality criterion, supplemented with other relevant information which may include: EPA's Water Quality Standards Handbook, October 1983, risk assessment data, exposure data, information about the pollutant from the Food and Drug Administration, and current EPA criteria documents".

Dissolved Oxygen Threshold:

**Deliberative Process / Ex. 5**

Eelgrass Threshold:

**Deliberative Process / Ex. 5**

Deliberative Process / Ex. 5

Reasonable Potential:

Deliberative Process / Ex. 5

Effluent Limit:

Deliberative Process / Ex. 5